Salient points with regard to the structural design of The World Trade Center towers:

1. The structural analysis carried out by the firm of Worthington, Skilling, Helle & Jackson is the most complete and detailed of any ever made for any building structure. The preliminary calculations alone cover 1,200 pages and involve over 100 detailed drawings.
2. The buildings have been designed for wind loads of 45 lbs. per square foot which is 2½ times the New York City Building Code requirements of 20 lbs. per square foot, the design load for the Empire State, Pan American and Chrysler Buildings. In addition to static wind loads, a complete dynamic analysis has been made to take into account extremely high velocity gusts.
3. The buildings have been investigated and found to be safe in an assumed collision with a large jet airliner (Boeing 707 - DC 8) travelling at 600 miles per hour. Analysis indicates that such collision would result in only local damage which could not cause collapse or substantial damage to the building and would not endanger the lives and safety of occupants not in the immediate area of impact.
4. Because of its configuration, which is essentially that of a beam 209' deep, the towers are actually far less daring structurally than a conventional building such as the Empire State where the spine or braced area of the building is far smaller in relation to the height.
5. The building as designed is sixteen times stiffer than a conventional structure. The design concept is so sound that the Structural Engineer has been able to be ultra-conservative in his design without adversely affecting the economics of the structure. This is not the case with conventional buildings where a more radical approach must be used if the building is to be constructed at reasonable cost.

CC9.P

WTCI-669-P

Scanned

Nov. 13, 2003

Saroj Bhol, P.E.
Manager, Design S
Engineering Dept
Gateway 3
Newark, N.J. 07102

THE PORT AUT... & NJ
QUALITY ... DIV.
ENGINEE... T.
NOV 17
RECEIVED
NOTED:
REFERRED TO: WTC File

Dear Saroj.

Pursuant to your request of November 7, 2003 I am enclosing herewith a copy of Malcolm Levy's White Paper dated 2-3-64. The heading of this 3 page writing is "Salient points with regard to the structural design of the World Trade Center towers."

The initials MPL:fg at the bottom of page 3 are for:

Malcolm P. Levy, Chief of Planning & Construction, later
Deputy Director for Physical Facilities
World Trade Department

and

Florence Grainger, Secretary to Malcolm P. Levy

Both Mal and Florence are deceased.

Sincerely,

John R. Dragonetti

5/28/88 Retired Project Administrator
Physical Facilities Division
World Trade Department

6. The structural concept is new but the design principles, the stress analysis and the theories of mechanics upon which the design is based are well known and are in accordance with good engineering practice.

7. The design has been reviewed by some of the most knowledgeable people in the construction industry. In a letter to John Skilling, the Structural Engineer for The World Trade Center, the Chief Engineer of the American Bridge Division of U. S. Steel Corporation said:
"In reviewing this design with our Operating and Construction Departments, we are very optimistic that you have turned a new page in the design of structural steel. It is high time that some new thinking be applied in our industry. In the words of our General Manager of Operating, Lester Larison, he said - 'It was the best damn thing that he has seen come down the pike in his 46 years of experience. Imagine designing a 100-story building for under 30 pounds per square foot.'"

8. The Engineering News-Record of January 30th carries a series of quotations from people in the building industry with regard to The World Trade Center design.

   A. James Ruderman, one of the outstanding New York Structural Engineers says that "The structural design of the tower buildings shows a commendable job of rethinking, where ideas were given a lot of thought and not just treated routinely."

   B. Harold Bernhard, partner, Shreve, Lamb and Harmon Associates, Architects, says "It's a magnificent project."

9. In an editorial in the same issue of the Record is the comment:
"Thus, the PNYA will not build as high as permitted all over its property, despite the high land costs in downtown Manhattan. Instead, the twin towers will occupy only 12% of the site. This plan should please the numerous vociferous critics of other recent New York projects not surrounded by large open spaces. It also permits the towers to be built

with no setbacks without violating zoning regulations. Over-all, the design not only appears to be esthetically preferable to a set-back silhouette, but also lends itself to more economical construction and use of space. The PNYA, in addition, has engaged noted architects and consulting engineers to design the project. From the preliminary data released, it appears that the design of the twin towers will mark an important advance in skyscraper construction. Tall buildings are handicapped economically because the cost of structural framing and the space consumed by vertical transportation rise rapidly with increasing height. The Trade Center designers have departed from usually conventional practices to cut these costs."

10. We have been informed that the structural engineering firm of Ammann & Whitney has been approached by a leading New York architect with a request that this structural system be reviewed for possible incorporation in a large office building which the architect is presently designing.

11. The skyscraper is one of America's contributions to World Architecture. New York is the capital of skyscraper construction in the United States. The design of the towers of The World Trade Center is based on the lessons learned in constructing all the tens of millions of square feet of high rise buildings in this great city. The towers may be said to be the first buildings of the 21st Century and the design concepts which they embody will be incorporated in some measure in every future high rise building ever built.

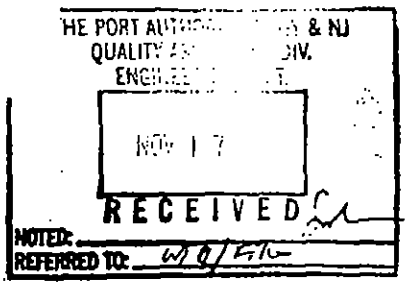
MPL:fg
2-3-64

Copy of 669-P

Scanned

Saroj Bhol, P.E.
Manager, Design S
Engineering Dept
Gateway 3
Newark, N.J. 07102

v. 13, 2003




Dear Saroj.

Pursuant to your request of November 7, 2003 I am enclosing herewith a copy of Malcolm Levy's White Paper dated 2-3-64. The heading of this 3 page writing is "Salient points with regard to the structural design of the World Trade Center towers."

The initials MPL:fg at the bottom of page 3 are for:

Malcolm P. Levy, Chief of Planning & Construction, later
Deputy Director for Physical Facilities
World Trade Department

and

Florance Greiner, Secretary to Malcolm P. Levy

Both Mal and Florance are deceased.

Sincerely.

John R. Dragonetti

5/28/88 Retired Project Administrator
Physical Facilities Division
World Trade Department

WTCI-669-P

Dragonette

Salient points with regard to the structural design of The World Trade Center towers:

1. The structural analysis carried out by the firm of Worthington, Skilling, Helle & Jackson is the most complete and detailed of any ever made for any building structure. The preliminary calculations alone cover 1,200 pages and involve over 100 detailed drawings.
2. The buildings have been designed for wind loads of 45 lbs. per square foot which is 2¼ times the New York City Building Code requirements of 20 lbs. per square foot, the design load for the Empire State, Pan American and Chrysler Buildings. In addition to static wind loads, a complete dynamic analysis has been made to take into account extremely high velocity gusts.
3. The buildings have been investigated and found to be safe in an assumed collision with a large jet airliner (Boeing 707 - DC 8) travelling at 600 miles per hour. Analysis indicates that such collision would result in only local damage which could not cause collapse or substantial damage to the building and would not endanger the lives and safety of occupants not in the immediate area of impact.
4. Because of its configuration, which is essentially that of a beam 209' deep, the towers are actually far less daring structurally than a conventional building such as the Empire State where the spine or braced area of the building is far smaller in relation to the height.
5. The building as designed is sixteen times stiffer than a conventional structure. The design concept is so sound that the Structural Engineer has been able to be ultra-conservative in his design without adversely affecting the economics of the structure. This is not the case with conventional buildings where a more radical approach must be used if the building is to be constructed at reasonable cost.

6. The structural concept is new but the design principles, the stress analysis and the theories of mechanics upon which the design is based are well known and are in accordance with good engineering practice.

7. The design has been reviewed by some of the most knowledgeable people in the construction industry. In a letter to John Skilling, the Structural Engineer for The World Trade Center, the Chief Engineer of the American Bridge Division of U. S. Steel Corporation said:
"In reviewing this design with our Operating and Construction Departments, we are very optimistic that you have turned a new page in the design of structural steel. It is high time that some new thinking be applied in our industry. In the words of our General Manager of Operating, Lester Larison, he said - 'It was the best damn thing that he has seen come down the pike in his 46 years of experience. Imagine designing a 100-story building for under 30 pounds per square foot.'"

8. The Engineering News-Record of January 30th carries a series of quotations from people in the building industry with regard to The World Trade Center design.
   A. James Ruderman, one of the outstanding New York Structural Engineers says that "The structural design of the tower buildings shows a commendable job of rethinking, where ideas were given a lot of thought and not just treated routinely."
   B. Harold Bernhard, partner, Shreve, Lamb and Harmon Associates, Architects, says "It's a magnificent project."

9. In an editorial in the same issue of the Record is the comment:
"Thus, the PNYA will not build as high as permitted all over its property, despite the high land costs in downtown Manhattan. Instead, the twin towers will occupy only 12% of the site. This plan should please the numerous vociferous critics of other recent New York projects not surrounded by large open spaces. It also permits the towers to be built

with no setbacks without violating zoning regulations. Over-all, the design not only appears to be esthetically preferable to a set-back silhouette, but also lends itself to more economical construction and use of space. The PNYA, in addition, has engaged noted architects and consulting engineers to design the project. From the preliminary data released, it appears that the design of the twin towers will mark an important advance in skyscraper construction. Tall buildings are handicapped economically because the cost of structural framing and the space consumed by vertical transportation rise rapidly with increasing height. The Trade Center designers have departed from usually conventional practices to cut these costs."

10. We have been informed that the structural engineering firm of Ammann & Whitney has been approached by a leading New York architect with a request that this structural system be reviewed for possible incorporation in a large office building which the architect is presently designing.

11. The skyscraper is one of America's contributions to World Architecture. New York is the capital of skyscraper construction in the United States. The design of the towers of The World Trade Center is based on the lessons learned in constructing all the tens of millions of square feet of high rise buildings in this great city. The towers may be said to be the first buildings of the 21st Century and the design concepts which they embody will be incorporated in some measure in every future high rise building ever built.

MPL:fg
2-3-64